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To cite this article: Maarten Bavinck (2020) Implications of legal pluralism for socio-technical transition studies – scrutinizing the ascendancy of the ring seine fishery in India, The Journal of Legal Pluralism and Unofficial Law, 52:2, 134-153, DOI: [10.1080/07329113.2020.1796297](https://doi.org/10.1080/07329113.2020.1796297)

To link to this article: <https://doi.org/10.1080/07329113.2020.1796297>



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Published online: 27 Jul 2020.



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Implications of legal pluralism for socio-technical transition studies – scrutinizing the ascendancy of the ring seine fishery in India

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ABSTRACT

This paper considers the contribution of legal pluralism scholarship to the field of socio-technical transition studies. Making use of a case study on the changeover to ring seine fishing in India, it pays particular attention to the implications of legal pluralism – or the co-existence of multiple legal systems in a societal field – for the stability of such transitions. Ring seine fishing developed in particular niches in the 1970s to spread swiftly throughout the subcontinent, dividing the fisher population into fervent protagonists and antagonists. Arguing that socio-technical innovations are often contested and that rival parties make use of alternative legal systems to advance their rights, the paper suggests that so-called regimes function as arenas for deliberating and battling alternative futures in fishing. Rather than creating stability for a particular socio-technical transition, such regimes may actually mask deep socio-legal divides.

ARTICLE HISTORY

Received 24 May 2020
Accepted 14 July 2020

KEYWORDS

Legal pluralism; socio-technical transition; regime; ring seine fishing; India

1. Introduction

This paper makes use of what is known as socio-technical transition studies, and particularly the multi-level perspective (Schot and Kanger 2018), for understanding contemporary developments in Indian capture fisheries. It adds to transition literature by introducing the concept of legal pluralism (Bavinck and Gupta 2014), and the complications such pluralism frequently creates for the understanding of innovation dynamics. On the basis of a case study on the contested rise of ring seine fishing in southern India, it enquires into the implications of legal pluralist contexts for socio-technical regimes and their functioning.

Capture fisheries are known not only for the diversity of harvesting technologies, but also for their propensity to change over time (Valdemarsen 2001; Tietze et al.

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2005). Not only do individual fishers constantly assess the effectiveness of their equipment and make adjustments, collectives of fishers regularly adopt new fishing gear in order to better make use of the opportunities provided by the natural environment, the market, and the regulatory order. The changes made are not only technical in nature, they involve adjustments in fishing practice as well as in economic, social and political circumstances. Major, collective changes in fishing technology are therefore usefully analysed as socio-technical transitions (Geels 2004). As capture fisheries is a time-tested and appreciated marine activity, it is part and parcel of what is now known as the effort toward achieving 'Blue Growth'. This is certainly the case in countries like India, where governments are still aiming to boost the productivity of capture fisheries further (Government of India 2017).

The empirical focus of this paper is on the emergence of a new, down-sized form of purse seine technology in India, known locally as ring seine fishing. Not only has this practice by now spread over the entire west coast, replacing other forms of fishing, it is now also moving up the east coast. However, this process of spatial dissemination is heavily disputed by fishers and actually prohibited by state governments, such as in Tamil Nadu and parts of Odisha (Bavinck et al. 2017; Ramachandran and Mohammed 2015; Sridhar et al. 2005). The district of Cuddalore, located in the upper reaches of Tamil Nadu, forms a contemporary hotspot of ring seine fishing. I analyse the socio-technical transition taking place there to build a general argument on the effects of legal pluralism on the 'stability' of transitions. Rather than viewing transitions as a smooth process with particular objectives, such as sustainability, I view it as undetermined, contested, and occurring at multiple, yet linked scale levels.

2. A theoretical perspective on socio-technical transitions

World fisheries are infamous for the crisis in which they are currently enveloped, generally known as 'overfishing' (FAO 2018). Overfishing, or the unsustainable exploitation of fish stocks, is the result of a widespread, prolonged and actually quite successful process of technical modernization that commenced in the 19th century (Bavinck 2011; Garcia et al. 2014; Smith 2000). Motorization, refrigeration, synthetic fibres, and fish-finding devices have generally increased the range and effectiveness of fishing operations and markets, thereby contributing to burgeoning catches but also to the present, ecological crisis. The world-wide, ongoing process of innovation, however, takes different forms in different geographical regions. The transition to ring seining that is now occurring in southern India constitutes one of these specific developments.

Tuomi-Nikula (1985) has argued that fisheries are organized into a variety of distinct yet interacting 'human niches', otherwise known as *métiers* (ICES 2003) or fishing styles (Boonstra and Hentati-Sundberg 2016). Although much fishing activity takes place within the seclusion of such niches, social struggle is also a feature of fisheries (Bavinck et al. 2018). This is largely a consequence of the fact that capture fishing occurs in a common pool resource, and is characterized by subtractability and difficulties of exclusion (Schlager and Ostrom 1993). Technical innovations in fishing will therefore easily affect other users, not only through the targeting of identical fish stocks, but also through technical externalities. In addition, fishers compete on the

market as well as for the favours of regulatory authorities. Social struggle can therefore pit fishers against fishers, but also against traders, governmental and non-governmental authorities, and other users of coastal space.

Socio-technical transition studies investigate the patterns and mechanisms in technological change processes (Geels 2002), highlighting transition pathways (Geels and Schot 2007), as well as, for example, issues of space and scale (Raven et al. 2012). Presented as a middle-range theory (Geels 2010), scholars in this field view tensions and mismatches that occur within systems as ‘windows of opportunity’ for innovation (Geels 2011), with ‘innovation’ generally perceived as a desirable phenomenon. In this paper, which centres on disputes, I shall take a more nuanced position, allowing for ‘unwanted’ innovation and for socio-political contestation.

Socio-technical transition studies divide socio-technical systems into three levels and parts, labelled niche, regime, and landscape (Geels 2004; Schot and Kanger 2018). Technical innovations are argued to commence in ‘niches’, described as “a protected space where promising new technologies are developed” (Hermans et al. 2013). Niche activities develop in reference to ‘regimes’, defined as the “semi-coherent rule sets directing the behaviour of a set of actors in a single socio-technical system” (Schot and Kanger 2018, 1055). As shall be noted below, regimes in socio-technical transition studies resemble legal systems, as understood in legal pluralism studies. Both niches and regimes are embedded in ‘landscapes’, which include larger, macro processes and conditions, outside the influence of the actors in a socio-technical system. As Raven et al. (2012) point out, systems exhibit spatial differentiation, and occur on temporal scales varying from the short-term (niches) and the medium-term (regimes) to the *longue durée* (landscapes). Socio-technical transition perspectives have been applied to a large variety of sectors, including fisheries (Haasnoot et al. 2016).

For the purpose of analysis, and in line with contemporary socio-legal scholarship, I adjust the above framework and specifically allow for the pluralization of regimes. Legal pluralism scholars point out that societies and societal sectors, rather than enjoying coherent legal regimes, are frequently characterized by normative plurality (Benda-Beckmann 2002) and multiple sources of law. This is to say that in reality various legal systems become applied to similar fields (Van der Linden 1971), providing citizens with different, and sometimes contradictory, forms of guidance. Such legal systems – which may have international, national or local sources and always some ‘staff of people’ (Max Weber, in Rheinstein 1954), or authority, for their deliberation and enforcement– are formal or informal in nature. Their interactions can be grouped into four types: indifference, conflict, accommodation and mutual support (Bavinck et al. 2013; see also Bavinck and Gupta 2014). Depending on the type of interaction that occurs between legal systems applied to a similar field and the power equations that pertain, the field is argued to be fragmented, ridden by strife, or relatively stable and coherent. The societal field I am interested in is a marine capture fishery in the throes of socio-technical transition.

Legal pluralism prevails in many aquatic regimes, caused by long histories of intensive use and diffusion of law, such as through colonial conquest (Bavinck and Gupta 2014). In many parts of the world, scholars have also identified legal pluralism as pervading the fisheries (e.g. Wiber and Parlee 2014). Fisheries in South India too have fruitfully been investigated from a legal pluralism angle (Bavinck 2001; Jentoft et al.

2009; Bavinck et al. 2013; Karnad 2017), with governmental and customary law vying for authority. Legal pluralism is recognized as creating specific dilemmas for governors who are in charge of 'steering' socio-technical developments (Jentoft and Bavinck 2014), but also for regular citizens who engage in forum-shopping (Benda-Beckmann 1981).

In Sections 3 and 4 below I trace the transition to ring seine fishing in South India, distinguishing various phases in the change process. The data on which this paper is based derive from a two-year exploratory research project (2016–2018), in which I led the enquiry taking place in Cuddalore District. I spent a total of four months in the region (August/September 2016 and 2017), walking the coastline from north to south, joining a ring seine fishing trip and otherwise talking to a variety of stakeholders (ring seine fishers, non-ring seine fishers, fisher leaders, civil society activists, scientists and government officials of various generations) on the issues affecting ring seine fishing. Remains to be said that these data were gathered in the context of a long-term research effort on fisheries in this geographical region, which commenced in the mid-1990s and has continued without interruption until the present.

3. The history of ring seining in India – an overview

The rise of ring seining in India is to be viewed against the backdrop, or socio-technical landscape, of fisheries development – a task that was taken up with urgency by the government of India after Independence. Scholars have noted that marine fishing is an age-old occupation in India, and that countless fishing castes have specialized in the trade (e.g. Subramanian 2009). At the time of Independence in 1947, the country was therefore already said to host 500 thousand marine fishers with, according to government, the main problem being low productivity (Chopra 1951). The Blue Revolution that the government of India subsequently initiated in parallel to 'revolutions' in industry and agriculture hinged on the import of new fishing technology. Fundamental to the effort was the Indo-Norwegian Project (INP), which commenced in 1953 and continued until 1972, introducing modern techniques of bottom-trawling and purse seining to India (Kurien 1985). Bottom-trawling was the first of these techniques to catch on, especially after trawl operators discovered foreign markets for shrimp in the late 1960s and prices went up manifold (Kurien 1978). Semi-industrial trawl fishers, however, soon came into serious conflict with the large population of small-scale fishers that was feeling threatened in their livelihoods. This conflict resulted in the rise of what became a national fisher movement (Sinha 2012) and in a first round of legislation curbing trawl operators. Meanwhile, INP had also experimented with purse seine technology, the result of which was – along the west coast – the rapid development of a fleet of large purse seiners, pursuing pelagic schools of fish (Edwin and Dhiju Das 2015; Pravin and Meenakumari 2016). Purse seines are a type of large surrounding net, in which the bottom of the net is closed after encircling a shoaling school of fish.¹ This technique, which – capital-intensive as the equipment is, may have been dominated by richer firms and individuals - resulted in manifold conflicts with small-scale fishers over resources (Nair and Jayaprakash

1983; Cruz 1998), and subsequently in attempts at government regulation (Pravin and Meenakumari 2016).

The marginalization of the numerous small-scale fishing population in India that occurred through the introduction of bottom trawling and large-scale purse seining was offset to some extent by the motorization of small craft, which commenced in Kerala in the early 1980s (Cruz 1998) and then spread to other parts of southern India. Motorization increased the range and speed of small-scale fishers, and also provided them with a measure of countervailing power with regard to intruding trawlers and purse seiners (Bavinck 1997). While the fishing population along many coastlines had already been acquainted with encircling techniques (the shore seine is the most prominent example hereof), the motorization of small craft also provided a crucial platform for the down-sizing of purse seine technology. The mini-purse seine, now known as the ring seine, therefore made its appearance among small-scale fishers along the south-west coast of India in the early 1980s (Edwin and Dhiju Das 2015).

There are two accounts of its genesis and spread. The first connects it to an initiative of the ICAR-Central Institute of Fisheries Technology (ICAR-CIFT) in Kochi, Kerala, in 1982 (Edwin and Dhiju Das 2015; Pravin and Meenakumari 2016). The other, more detailed account links the development of ring seining to the initiative of ingenious small-scale fishers in various parts of Kerala, who were inspired by their new knowledge of large-scale purse seining, probably acquired through working on purse seiners, as well as by prevailing fishing practices in their region of origin (Cruz 1998). Cruz (1998, 6–11) argues that the diffused pattern of innovation resulted in two major types of ring seine practice: (1) plank-built canoe ring seining in southern Kerala, and (2) dugout canoe ring seining in northern Kerala. From Kerala, where it is now the dominant mode of fishing (Edwin and Dhiju Das 2015, 90), ring seining are argued to subsequently have spread to the north-west coast of the country, and gradually to the east coast too (Pravin and Meenakumari 2016).

Cruz (1998) divides the rise of ring seining along the west coast into three phases. The first is the origin, or innovation phase (1985–1986), which is followed by a growth and development phase (1987–1990). A census by the South Indian Federation of Fishermen Societies (SIFFS) revealed that at the end of the latter period there were 2259 ring seine units in Kerala, equivalent to 4.47 ring seines per kilometre of coastline (Pravin and Meenakumari 2016, 14,45). As ring seining spread along the Kerala coast, so, however, did tensions with small-scale fishers who were not partaking in this technological shift – a topic to which I shall return in the next section. According to this author, growth is finally followed by a saturation phase and even a decline phase (since the early 1990s), “indicating [...] that there is no scope for further expansion or increase in number of ring seine units in Kerala” (Pravin and Meenakumari 2016, 41). Whether this was indeed the end of the story in Kerala is doubtful (cf. Edwin and Dhiju Das 2015; Ramachandran and Mohammed 2015), but I shall leave the analysis of further events on the west coast for others to pursue.

Socio-technical transitions such as ring seining have occurred in relation to prevailing conditions in the marine environment on the one hand and the market on the other. With inshore and offshore waters being relatively rich in demersal as well

as pelagic species, which were considered underexploited at the time of Independence (Chopra 1951), the various modernizations that took place resulted in spectacular increases in catch levels, boosting marine fish production almost eight-fold from approximately 47,000 MT in 1948 to 3,583,000 MT in 2015 (Government of India 2017). In latter decades, however, harvesting levels have largely stabilized, and catches per unit of effort have gone down, with significant evidence of ‘fishing down the foodweb’ (Bhathal and Pauly 2008). Indeed, the National Policy on Marine Fisheries has recently concluded that “fisheries resources from near-shore waters are fully utilized” (Government of India 2017, 14) and that it is now only the deep-sea that offers opportunities for intensification.

The decline of inshore fisheries that is noted in this recent policy document was actually experienced by fishers already in the 1990s (Bavinck 2001), and scientists too have occasionally issued warnings on the dangers of uncontrolled innovation. The respected fisheries scientist Silas et al. (1980), writing about the rise of purse seine fishing on the west coast, thus argued that “[s]uch wasteful and destructive fishing could irreparably damage the fish resources” (1980, 3), and plead urgently for better regulation. Similar voices appear in the contemporary discussion of ring seining in Tamil Nadu.

The market too was favourable to the introduction of new fishing technologies in inshore waters. I have already mentioned the impetus of the international market, first for shrimp and later for other seafood products. With seafood prices rising continuously on a long-term basis, both internationally (Delgado et al. 2003) and locally ((Government of India 2014, chart 9), there has been a strong incentive for entrepreneurs in India to invest in fisheries. The rise of ring seining begs a slightly different explanation, however, as it depends largely on small and low-cost fish species, such as sardines, anchovies and mackerel. While there is a growing domestic consumer market for these species too, the demand for these varieties of seafood derives from the international market as well as the fish meal industry, which has been growing rapidly in India.

Mention now needs to be made of the state-based regulatory regime in marine fisheries and its relation to technical innovation. I have already noted the interest of the governments of India (both central and state-level) in the modernization of fisheries in the post-Independence era. The Constitution provided a foundation for this effort by unequivocally appointing state governments in charge of fisheries in territorial waters (within 12 NM from shore) and the central government in charge of fisheries in the remainder of the Exclusive Economic Zone. Importantly, the Constitution (Article 19 g) stipulates that every citizen of India is allowed to engage in any profession; this opened the opportunity for non-fishers to invest in fishing - a frequent occurrence, certainly in the early innovation phases of trawling and purse seining (Kurien 1978; Bavinck 2001).

Jurisdiction for regulating marine fisheries emerged only in the 1980s, following the spate of violent conflicts between trawl fishers and small-scale fishers along the entire Indian coast.² In response to a model bill circulated by the Central Government, state governments began to formulate legislation for regulating marine fisheries, with a focus on separating the two warring parties. The Tamil Nadu

Fisheries Regulation Act thus came into force in 1983; while it has repeatedly been supplemented by means of government order, it has recently undergone a more comprehensive revision (2017).

For the topic of this paper, another government notification (GO 40 of the Department of Animal Husbandry and Fisheries, Tamil Nadu, dated 25.3.2000) is relevant. It states:

“In exercise of the powers conferred by [...] the Tamil Nadu Marine Fishing Regulation Act, 1983 [...], the Governor of Tamil Nadu hereby prohibits fishing [...] with Purse-Seine nets by any fishing vessel/craft, whether country craft or mechanised boat, irrespective of their size, and power of the engine, in the entire coastal areas of Tamil Nadu in the territorial waters, as a measure to conserve the fishery.”

Not only is this notification valid for the entire coastline of the state and all marine waters over which state governments hold jurisdiction, it pertains to all kinds of fishing activity, by small-scale and semi-industrial (or, mechanized) vessels alike. The notification is motivated in reference to conservation needs, which, as will be noted below, are contested.

State law is, however, not the only source of regulation in Tamil Nadu fisheries, where legal pluralism is the rule. The fisheries of the Coromandel Coast, that stretches over approximately 400 km of shore, are thus well-known for the strength of caste-based fisher councils, or *ur panchayat* (Tamil), which have traditionally played a key role in ensuring the wellbeing of hamlet populations (Bavinck and Vivekanandan 2017). Rooted in patrilineal kinship structures, and based on principles of equality, *ur panchayats* provide strong, local decision-making platforms, taking care of dispute resolution, representation to government, community welfare, and fisheries management (Bavinck 2001). The latter activity hinges on the widely shared notion that adjacent lands and waters ‘belong’ to the local *ur panchayat*, which is therefore also in charge of deciding on the legitimacy of new fishing technologies and practices. Such technologies and practices are evaluated according to three possible types of harm: harm to the marine environment, harm to the majority style of fishing, and harm to the community as a social entity. A negative judgement of *ur panchayats* can lead to a banning of the respective gear (Bavinck and Karunaharan 2006). Each fisher settlement along the Coromandel Coast possesses an *ur panchayat*, while there is also a system of regional cooperation through panchayat circles or ‘head villages’ (Tamil: *talai nagar*).

4. Zooming in on cuddalore district

Cuddalore District is situated halfway the Coromandel Coast of Tamil Nadu (see Figure 1) and is notorious for the impact of natural as well as man-made disasters. The former follow from cyclonic storms and – rare - tsunamis, while the latter are linked to the establishment in the 1980s of a large Petroleum, Chemicals and Petrochemicals Investment Region (PCPIR) that has since been associated with multiple pollution scandals.

The Cuddalore coastline has a length of 57 kilometres and is dissected by two major rivers and an extensive backwater, which separates the coastal belt from the

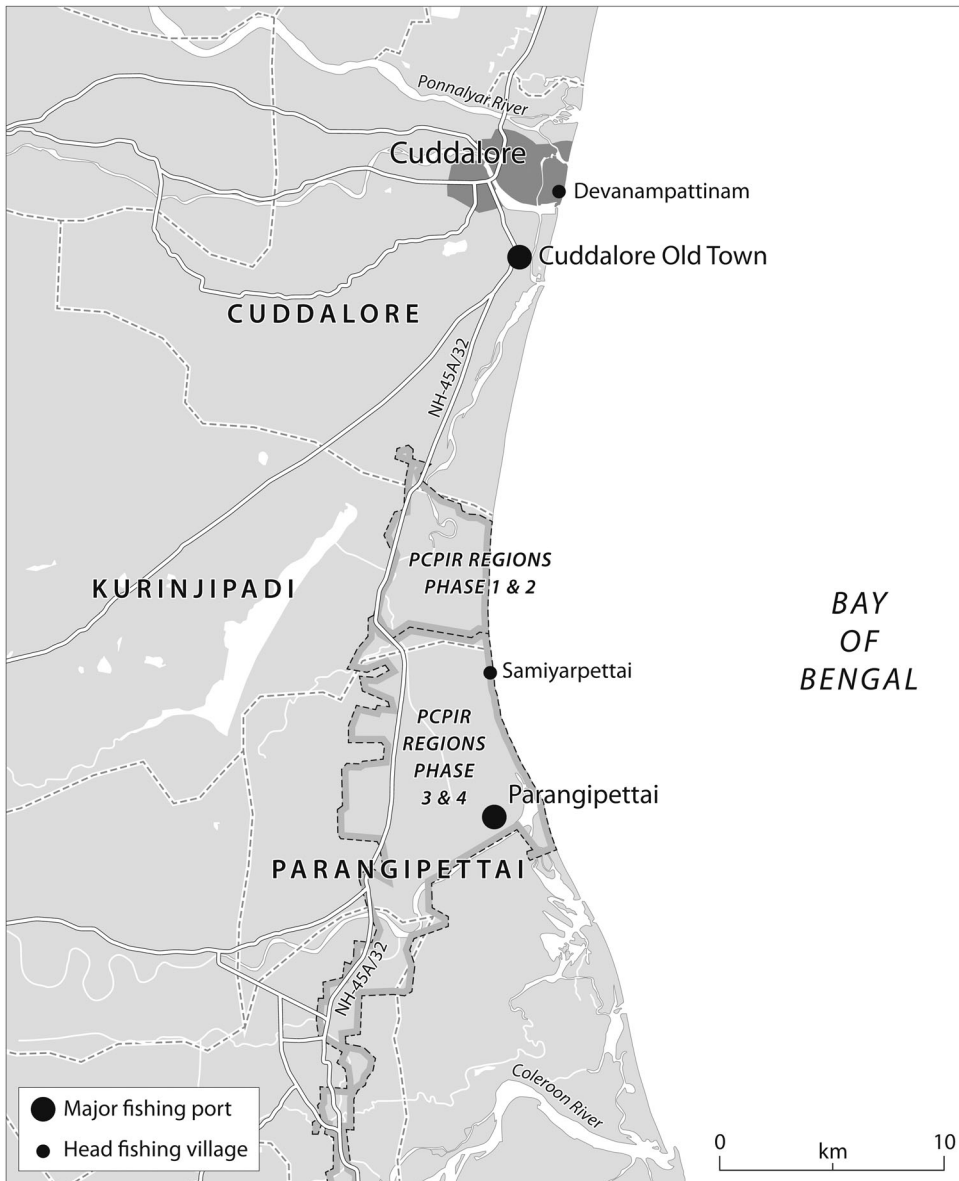


Figure 1. Cuddalore District, Tamil Nadu.

Source: UvA Kaartenmakers

interior. The Fisheries Department counts a total of 47 marine fishing hamlets, partially clustered around three urbanizing harbour locations (Cuddalore OT, Pirangipettai and Mudasolodai) and otherwise spread along the coast (Fisheries Department (Tamil Nadu) 2010). The marine fishing population is currently estimated at approximately 45,000, in majority belonging to two fishing castes: the Pattinavar and the Paravatharajakulam. The latter are concentrated in the central part of the coast, while the Pattinavar dominate settlements in the northern and the southern reaches.

Several events and processes have left a major mark on the marine fishing population of the District in recent times, in random sequence: the tsunami of 2004, the rapid industrialization of the coastal zone, and the ongoing modernization of fisheries. The tsunami that swept the low-lying Cuddalore shore in December 2004 caused many deaths and extensive material damage, particularly among the fishing population. Following the tsunami, the government relocated a number of fishing hamlets to the backwater, while others were provided with seawalls and ecosystem-based protection measures. Transportation infrastructures improved and small-scale fishing witnessed a major change-over from traditional, wooden craft known as *kattumaram* to small, fibreglass-reinforced boats. Population increases had meanwhile also contributed to an increase of fishing effort.

While most chemical industries were established around the backwater and not along the coast, the coastal population has nonetheless experienced negative side-effects. One of these is the construction of numerous jetties and pipelines for the import of raw materials and the discharge of waste – these infrastructures inevitably occupy coastal lands and waters, interfere physically with fishing operations, and are held to affect the health of fish stocks and marine ecosystems. In order to compensate fishing populations for undesirable side effects, the fisher councils have negotiated deals with industrial companies, whereby the latter make annual contributions to temple festivals and reserve a limited number of low-paying jobs for people from adjacent hamlets.

The Blue Revolution that was launched by the government of Tamil Nadu affected the fishers of Cuddalore District in similar ways as those in other parts of the country. While large-scale purse seining never developed like it did on the west coast, two large trawl centres did emerge in the District (Cuddalore OT and Mudasolodai), with trawl activity centred on the more resource-rich, inshore zone where small-scale fishers too ply their craft (Lawrence and Bhalla 2018). A section of the small-scale fishing population subsequently made a transition to trawl fishing, either as owners but more frequently as crew, sometimes migrating permanently to harbour towns inside or outside the District for this purpose. The majority, however, continue to engage in small-scale fishing, making use of the range of drift netting technologies that prevail along the Coromandel Coast (Bavinck 2001). These target the various, marketable species that are available in the Bay of Bengal in different seasons. It is important in this connection to note that the species currently targeted by ring seines are part of the basket of regular small-scale fishers.

Many fisher respondents in Cuddalore District who were interviewed in 2016 and 2017 expressed pessimism about the future of the marine fisheries. Along this entire coastline, there is also a strong drive to educate children, with as motivation that it would hopefully help the younger generation to get out of what is felt to be the dead-end street of fishing. Meanwhile, ongoing research demonstrates that many adult fishers are currently spending a varying number of years in Gulf countries or in Singapore, ‘pushed out’ by the poor condition of the local fisheries, and ‘pulled’ by the opportunities of earning good money abroad. All in all, these developments point to a broadening of the perspective of Cuddalore fishers beyond the hamlet, the coastal strip, and the fishing profession. It is in this ‘landscape’ that ring seine fishing emerged.

Ring seine fishing in Cuddalore District is regulated from two sources. The first is the district administration, headed by the Collector, who for fisheries matters depends strongly on the Assistant-Director of Fisheries and his/her small staff. Both are based in Cuddalore town. Fisher law emanates from the fisher councils that function in each hamlet. Although these councils still possess considerable force, recent research (Bavinck and Vivekanandan 2017) demonstrates variability with regard to structure, scope, and activity; these are probably related to changes in the macro-environment, or landscape, as sketched above.

Fishers in this district recognize two head villages: Devanampattinam and Samiyarpettai. The former plays a leading role among the Pattinavar fishing population, while the latter does the same for the Paravatharajakulam. Both villages and their councils have an important part in the transition to ring seine fishing, to which I now turn.

5. Contestations over ring seine fishing in Cuddalore District

Ring seine fishing technology swept up the coast from southern Tamil Nadu, reaching the fishing port of Pazhayar, at the border of Cuddalore District, in the late 1990s. United under the flag of the Devanampattinam village council, a large fleet of irate Cuddalore fishers travelled to Pazhayar and set fire to the ring seine nets (Tamil: *surukkuvalai*) being used there (Bhalla 2006). This incident marked widespread resistance to ring seine technology and temporarily put adoption on hold. Respondents point out, however, that in the years that followed, more and more fishers in Cuddalore District became aware of the financial advantages of ring seine fishing. Thus, as a former official of the Fisheries Department pointed out, “other fishing methods were not generating big catches, and ring seining provided new opportunities for small-scale fishers” (interview 15-9-2016). Interestingly, it was the fishers of Devanampattinam village who converted first - and wholeheartedly - to the technology, with fishers from other villages following in their wake. Respondents agree that this transition gained momentum especially after the tsunami of December 2004.

Various encircling fishing techniques were at that time already being practiced along the Coromandel Coast for capturing passing schools of pelagic fish.³ Ring seine gear presented an upgrading of these earlier techniques and was attractive to small-scale fishers as it was eminently suited for share-ownership. The labour requirement for ring seining being high (normally 30-60 persons), it made sense for fishers to unite in investment or labour groups; small ring seine nets (approx. 400 metre in length, Tamil: *adantavalai*) would be purchased – new or secondhand - by shareholder groups of twenty to thirty fishers, who would then commit to jointly operating the gear.⁴ Returns would be split equally among the members. The advantage of this fishing mode was that it did not immediately require the purchase of a new vessel; instead, the motorized craft that were normally used for small-scale fishing (and that had become quite plentiful after the tsunami) could be used for this purpose. Ring seining took place on a daily basis for smaller pelagic species such as sardine and mackerel, with the beach as landing site.

This form of ring seine fishing is still practiced in a number of fishing villages along the Cuddalore coastline. With small ring seine nets costing between Rs 500 and 700,000 (US\$7,000–10,000, secondhand) and Rs 1 million (US\$14,000, new), a share would normally cost less than Rs 25,000 (US\$350) a member. In addition to this democratic and rather simple form of ring seining, however, new, more capital-intensive and harbour-based forms too entered the scene, with core technology again being imported from Kerala.

The first so-called *kanaa* boat, a high-prowed vessel of 15–20 metre length, fitted with winches and specifically designed for ring seine fishing, was probably brought to Cuddalore town in 2006 (interview 12-9-2016). Not only were investment levels higher (a second-hand *kanaa* boat can now be purchased for US\$28,000), but this kind of vessel made more distant fishing for larger pelagic species possible, also allowing for longer nets (1500 metres length). In addition to the cost of the nets (which are longer and therefore more expensive) the fisher now also has to invest in a new carrier craft. Each carrier is then serviced by 4–5 smaller boats that assist in fishing operations. For larger pelagic species, the mesh size used has increased to 40–80 mm (Tamil name of net: *peyantavalai*). For *kanaa* fishing too, shareholdership is a regular phenomenon. Interestingly, respondents agree that the number of shareholders joining in a *kanaa* group has declined from an average of 20 members to 5–10 members. This is indicative of the increasing wealth of fishers involved in *kanaa* fishing. Cuddalore district now counts one major fishing ports with substantial numbers of *kanaa* boats: Cuddalore Old Town (estimate: 150 vessels) and Pirangipettai (less than 20 vessels). The owners/operators of these fleets derive from multiple fishing villages along the coast, with observers all agreeing that Devanampattinam is the centre of trade. *Kanaa* boats are said to operate both in the in- and in the offshore, thereby coming into conflict with small-scale operators.

The most recent addition to the fleet consists of large steel boats that go for multi-day fishing trips to distant waters and can probably be considered regular purse seine vessels. They target the most valuable of pelagic species, such as tuna, and are said to cost Rs. 12 million (US\$168,000) each (including gear). Operating costs are estimated at Rs 300,000 (US\$4,300) a voyage. Although share ownership prevails here too, the original system of shareholder/crew participation has been abandoned. Workers now frequently derive from agricultural regions and owners frequently do not go for fishing themselves anymore. Moreover, more wealthy shareholders appear to often invest in more than one vessel.⁵ All these vessels are based in the same harbours as the *kanaa* vessels are.

The transition that has taken place in Cuddalore District to ring seine fishing has several defining features. First, one discerns a move from small-scale ring seine technology to larger, more capital-intensive forms, all of which still co-exist along the coast. Second, while collective shareholdership is still the norm, the size of the ring seine-operating groups is reducing in line with the wealth of individual fisher investors. Traders appear to have played a role in funding the initial shift into ring seining, but their role has declined over time. Although the ring seine fleets are largely based in the same locations as the trawl fleets of Cuddalore District, there appears to be limited interaction between these segments, with a certain degree of animosity

prevailing between trawl and ring seine fishers.⁶ Third, ring seine fishing is now often considered to be the fishing populations' *mukkiyamaana tozhil* (most important line of work), in contrast to small-scale fishing (Tamil: *sinna tozhil*, or small time work). In this, it differs from trawl fishing, which has always been seen as a sector in which small-scale fishers could not easily participate. Finally, I have noted that ring seine fishing has been contested from within the fishing population, even from its inception. I will return to this point below, after first sketching the opinions that fishers, government officials, scientists and activists venture about ring seining in Cuddalore District and the region at large. It is good to commence this sketch with the warning uttered by a social activist working among fishers that "ring seining is a very sensitive issue, one that one should not raise with fishers until the very last" (interview 2-9-2016). This advice proved to be quite pertinent, as fishers – particularly those actually involved in ring seining – tended to stiffen whenever the topic was mentioned.

Opponents of ring seine fishing in the district tended to stress two aspects. First of all, ring seine fishing is held to result in an overall depletion of inshore fish stocks. By harvesting complete schools of fish (juveniles, adults, egg-bearing females), overall fish stocks are argued to decline. This is suggested to have other negative consequences too: predator fish will no longer come inshore. Secondly, ring seine fishing is argued to benefit a certain segment of the fishing population to the exclusion of others. Small-scale fishers in the region, who make use of drift nets, have seen their catches of sardine, mackerel and other schooling species decline. Theirs is an argument of fairness and social justice. Proponents of ring seine fishing on the other hand point out the extreme fecundity of many pelagic species and the lack of scientific evidence for overfishing. They also note the general crisis prevailing in the fishing sector and the unavailability of income-generating alternatives. They finally point out that other state governments of India, such as in Kerala, have sometimes even encouraged fishers to take up ring seining.

Fact is that the debate over the potential harmfulness of ring seine fishing has been around for a long time. The early counsels of Silas et al. (1980) were noted above. Such warnings, to which were added the vehement protests of fishers along the coast of Tamil Nadu, undoubtedly inspired the government notification banning ring seine fishing in Tamil Nadu. In Cuddalore District, the effort to limit ring seine fishing was actually taken up by the chief administrator, Singh Bedi, who became popular in fishing circles because of his handling of the tsunami disaster. In his wake, the Fisheries Department conducted a number of meetings in the district, warning fishers of the dire consequences of ring seine fishing (interview ex-AD Fisheries 15-9-2016). Bedi's spirited opposition to ring seining is still referred to by fishers today (interview 7-8-2016).

But the fishers of Cuddalore District themselves also took remedial action. After the inhabitants and the village council of Devanampattinam abruptly gave up their opposition to ring seine fishing and joined the band wagon, it was Samiyarpettai head village that led the protest against incipient ring seine activity. This resulted in a peace meeting that took place in the District Collector's office on March 12th, 2004. It was attended by fisher representatives from both sides, as well as a number of government officials, including the Fisheries and the Police Departments. The meeting

resulted in a resolution, signed by all those present, that ring seine nets should no longer be used.⁷

As ring seine fishing in Cuddalore District started to boom in the post-tsunami period, and more and more village councils gave up their opposition to this technique, a group of 23 villages, or almost half the total number of marine fishing villages in the district, headed by Samiyarpettai persevered. Not allowing ring seine fishing to be taken up by their own members, they continued to lobby against the use of this technology, each council sending a letter to the District Collector, with a cover letter from Samiyarpettai, asking for enforcement of the government ban. This led to another peace meeting on June 21, 2016, attended again by fisher representatives from both sides as well as a number of government officials. The decision taken at the meeting was that a limit be placed on the number of ring seine units presently employed in the district and that ring seining would be terminated altogether within one year's time. The latter clause was added so as to allow those who had invested in ring seining to recover their investments. But the decisions of this meeting again have not been followed up, and it was clear at the time of my fieldwork in 2016 that new ring seine units were being added. In addition, fishers from Samiyarpettai complained that, in retribution for their opposition to ring seining, fish traders in Cuddalore town had stopped purchasing from other vessels belonging to people from their village. One year later, a young fisher from Samiyarpettai voiced disappointment in the effects of the peace meeting, complaining that the government should have acted more forcefully to make sure it was implemented.

“The government should have restricted banned nets, such as ring seine before. Now they cannot do so anymore – people have invested so much money. The only thing to be done now is to boost awareness among fishers and bring about change – a form of slow action. The government should actually be doing more now, as fishing is currently so poor.” (Interview 3-9-2017).

In the following section, I reflect on the troubled transition to ring seine fishing as it has taken place in Cuddalore District.

6. Discussion

The socio-technical transition to ring seine fishing discussed in Section 5 above has several core features. First, the technology – which constituted a radically modernized version of existing encircling techniques – was introduced to and developed in ‘niches’ along the west coast of India. It subsequently disseminated to what might be termed ‘subordinate niches’ along the east coast, from where it eventually entered Cuddalore District, Tamil Nadu.

The ‘landscape’ of this transition was multi-dimensional, broad-based, and anchored in a policy framing of ‘innovation for growth’ (Schot and Steinmueller 2018). The technology itself originated in European practice as well as in multi-lateral development cooperation projects that introduced it locally to India. It was sold to and embraced by Indian governments as an enabler of production levels and also adopted by individual fishers eager to offset the decline in catches caused at least partly by overfishing.

The 'regime' governing the introduction and practice of ring seine fishing, however, is less straightforward. Subsequent governments of India, that assume a monopoly over fisheries regulation in the country, have adopted different standpoints, sometimes allowing the practice of ring seining, sometimes disallowing it, and in any case not providing a nation-wide framework of regulation. Thus, for example, while the Tamil Nadu government has officially prohibited ring seining, Kerala is allowing it. Much of the equipment now used in Cuddalore District is therefore legally purchased in Kerala and transferred to Tamil Nadu. Moreover, even though the Tamil Nadu government has officially disallowed ring seining, it is not making efforts to implement this regulation. The most glaring example is found in the harbour of Cuddalore Town, which contains a large and active fleet of 'illegal' ring seine vessels that still go out regularly for fishing. The only difference between these vessels and other fishing craft in the harbour is that the ring seine boats are not officially registered with the Department and therefore not insured nor eligible for fuel subsidies.

Parallel to the fractured and ineffectual nature of government regulation there is a strong, but increasingly variable system of customary law, anchored in fisher councils at the village level. The unanimous opinion of council members and ordinary fishers alike is that, on the basis of historical precedence, they have a moral right to governing inshore fishing space. The main mechanism by which councils do so is by banning fishing practices that are considered harmful. Thus at the inception of ring seining in the region the fisher councils of this coastline joined for a punitive expedition against perpetrators in an adjacent harbour town. In subsequent years, however, fisher opinion divided, with one group of councils in favour of an overall ban on ring seines, while another group strongly supported the use of the technology. The peace meetings organized under the auspices of the district administration brought no solace. Their decisions to gradually eliminate ring seining in the district were contradicted by an actual rise in the number of ring seine units. The rapid rise and preponderance of ring seining in the district can therefore superficially be read, in terms of socio-technical transition thinking, as an expression of increasing 'stability'. In view of the contested legitimacy of ring seining, not only within the fisher population but in circles of government, science, and civil society too, however, this reading is problematic. Opponents of ring seining share a substantial worry about the environmental sustainability of this form of fishing, as well as about the social injustice it is creating.

7. Conclusion

Besides the niche and the landscape, sociotechnical transition studies emphasize the importance of the prevailing institutional regime. The assumption is that regimes are semi-coherent in nature, thereby "accounting for the stability of [socio-technical] configurations" (Geels 2002:1260; cf. Schot and Kanger 2018). The case of ring seine fishing in India demonstrates, however, that transitions sometimes occur in contexts of legal plurality. The question raised by this paper regards the effects of legal pluralism on sociotechnical regimes and transition processes.

Before proceeding, it must be noted that authors in the field of sociotechnical transition studies, while generally emphasizing the ‘alignment of rule-sets’ (Schot and Kanger 2018, 1053), do allow for the availability of tensions and misalignments within regimes (Geels 2004, 2011). Such tensions are even argued to create ‘windows of opportunity’ for innovations to break out of the niche level (Geels 2002, 1263). I argue that legal pluralism provides a conceptual advance by emphasizing the systemic and prolonged nature of some such tensions and their rooting in normative, socio-legal frameworks, enacted by different authorities.

Legal pluralism causes institutional fragmentation, which impacts ordinary citizens partaking in that societal field as well as authorities in charge of the various legal systems. Citizens, who are often used to living under conditions of interlegality (De Sousa Santos 2002, in Simon Thomas 2009), are known to engage in forum-shopping (Benda-Beckmann 1981) but may also mobilize in defence of their normative views on justice. Likewise, authorities in charge of various legal systems sometimes ‘shop’ for cases but also engage in rivalry and negotiation. The latter may bring about forms of institutional bricolage (Clever 2012), or the crafting of new institutional structures and processes with elements from different sources.

Bavinck et al. (2013) have proposed a typology for the relations between legal systems in a societal formation, distinguishing between indifference, conflict, accommodation and mutual support.⁸ They argue that the nature of the relationship has important effects on governance. Continuing this line of thought, this paper suggests that the type of relations prevailing between legal systems will also affect the transition process and its stability. A situation of conflict between legal systems thus has other implications than where mutual support takes place, or where legal systems are indifferent to each other’s role. In the former instance, a sociotechnical transition – despite appearances – may actually be highly unstable and disputed.

Three points are worth noting. The first is that the quality of legal pluralism plays a role in stability. Legal pluralism scholars distinguish between ‘weak’ and ‘strong’ (or ‘deep’) forms of legal pluralism, whereby the former gathers under the umbrella of, for example, a state legal order, and the latter denotes the co-existence of distinct legal systems (Griffiths 1986; Woodman 1998). In the latter case, differences between legal systems go beyond law and legal procedure, and link to variations in social and economic structure, as well as knowledge. Such ‘strong’ variations are sometimes analysed as modes of production (Sanyal 2007), with contradictions occurring between capitalist and so-called moral economies (Menon et al. 2018). A strong legal pluralism perspective thus draws attention to fundamental tensions that occur the very field in which a sociotechnical transition is taking place.

The second point is that power equations and politics play an important role in the stability of any sociotechnical transition, as they do in conditions of legal pluralism (Jentoft and Bavinck 2014). If one legal system and its members dominate the field, long-term stability is more likely than when legal systems rival each other in strength. In the latter case, such as in the instance of ring seining in India, the stability of transition is more in question. Whatever the situation may be, it makes sense to ask the question central to political ecology studies (Karlsson 2015): stability for

whom? Who is benefitting from the transition that is taking place, and who is losing out?

The final point is that in societal systems, such as fisheries, that lean heavily on ecological services for their existence (Costanza et al. 2017), a degradation of these services such as through harmful sociotechnical transitions may in the end bounce back to affect whatever stability exists. Here the realm of 'things' becomes an actor in the transition process, perhaps – but not necessarily – contributing to positive adjustments in the framing of innovation (Schot and Steinmueller 2018).

In this paper I have discussed the process of socio-technical transition as it has occurred in Indian ring seine fisheries, and the tensions that occur in regulating its forcefulness and direction. The thrust of the arguments was that legal pluralism studies have a contribution to make to the scholarship on transitions, by emphasizing the effects of fragmentation of the socio-technical regime.

Notes

1. For a description of the characteristics of purse seining see <http://www.fao.org/fishery/geartype/249/en> (accessed 19 December, 2018).
2. Previous to this time, marine fisheries was regulated according to the Indian Fisheries Act (1897), which mainly pertained to inland fisheries.
3. Respondents mention specialized gear such as beachseines (Tamil: *karavalai*) and lift nets (*idai-* or *madavalai*), but also driftnets that could on occasion be refashioned to encircle passing schools of fish.
4. The origin of the capital invested by small-scale fishers in ring seine ventures has not been thoroughly studied yet. Although some of this money seems to derive from foreign migration earnings, fish traders have sometimes provided loans in return for the right to purchase (part of) the catch. The involvement of such financiers may also have influenced the political dynamics occurring.
5. On August 20, 2016 I happened to meet with a boat owner *cum* fish trader in Cuddalore Old Town who boasted that he has shares in two *kanaa* boats and has recently ordered for the construction of a steel boat too.
6. Thus there is evidence of competition for labour and ice.
7. A copy of this resolution is in the author's possession.
8. This typology has been elaborated by Bavinck and Gupta (2014).

Acknowledgements

This paper follows from a project entitled 'Contesting the coastal commons: the changing socio-legal position of fishing populations in Tamil Nadu and Maharashtra' (Nr. W07.04.030.247) that was funded by the Netherlands Organisation for Scientific Research (NWO) and the Indian Council on Social Science Research (ICSSR). It was conducted in close collaboration with Prof. D. Parthasarathy (IIT-Bombay) and Prof. A. Menon (Madras Institute of Development Studies – MIDS) and benefited from the contribution of K. Subramanian and others. I express appreciation for comments made by Francesca Pilo and Aarthi Sridhar on earlier versions of this paper. In addition, I am thankful for the inputs made by two reviewers. An earlier version of this paper, entitled 'The troubled ascent of a ring seine fishery in Tamil Nadu', appeared in *Economic and Political Weekly* (volume 55 (14): 36-43).

Disclosure statement

No potential conflict of interest was reported by the authors.

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